PB-215 586

STUDY OF OMAHA, NEBRASKA, MEAT-PACKING WASTES

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

February 1965

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U. S. Department of Health, Education, and Welfare
Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

February, 1965

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STUDY OF

OMAHA, NEBRASKA MEAT-PACKING WASTES

A joint report of the City of Omaha, Nebraska, the Environmental Sanitation Division of the State Health Department of Nebraska, and the Public Health Service.

Acknowledgement is made of the cooperative review by the States of Iowa, Kansas, and Missouri.

Ia

TABLE OF CONTENTS

	PAGE NO.
SUMMARY	1
SUMMARY TABLE I and II	1-A
CONCLUSIONS	2
AUTHORITY	4
TIME OF STUDY	5
PERSONNEL PARTICIPATING IN THE STUDY SURVEY	5
PURPOSE	6
STUDY AREA	6
RAW MATERIALS	7
Livestock	7
OPERATIONS	7
EMPLOYEES	7
WATER SUPPLY	7
SEWERS	8
WASTE SOURCES	9
GREASE	9
SUSPENDED SOLIDS	9
BIOCHEMICAL OXYGEN DEMAND	9
COLIFORM	10

TABLE OF CONTENTS
(Cont.)

	PAGE NO.
SANITARY SEWAGE	11
SURVEY PROCEDURES	11
Sample Collection	11
Flow Data	11
Laboratory Analyses	12
PRESENTATION OF DATA	13
WATER USE	13
WASTES CONTRIBUTED	13
DISCUSSION OF RESULTS	15
GREASE	15
SUSPENDED SOLIDS	16
VOLATILE SUSPENDED SOLIDS	16
BIOCHEMICAL OXYGEN DEMAND (BOD)	17
CHEMICAL OXYGEN DEMAND (COD)	18
ORGANIC NITROGEN	18
COLIFORM	18
SEWAGE TREATMENT PLANT EFFICIENCY	19

TABLE OF CONTENTS
(Cont.)

APPENDICES

	PAGE NO.
AUTHORITY - Letter from Mayor of Omaha, Nebraska	A-1
LABORATORY ANALYSES - GREASE	A-2a
LABORATORY ANALYSES - BOD - SWIFT & COMPANY (Downstream)..	A-2b
DESCRIPTION OF SAMPLING POINTS	A-3
INDIVIDUAL ANALYTICAL RESULTS - TABLES 1 to 3	A-4

LIST OF TABLES

TABLE NO.		ON OR FOLLOWING PAGE NO.
1	Kill in #/Day (Live Wgt. on the Hoof)	7
2	Results of Analyses - Monroe St. Sewer	14
3	Results of Analyses - South Omaha Sewer . . .	14
4	Operational Results - Missouri River S.T.P. .	14
5	South Omaha Data Period (Dec. 7-12, 1964) . .	20

APPENDIX 4

1	Analytical Results	A-4
2	Total Coliform (MPN/100 ml	A-4
3	Fecal Coliform (MPN/100 ml)	A-4

LIST OF FIGURES

FIGURE NO.		FOLLOWS PAGE NO.
1	Map Showing Location of the Packing Plants	6

STUDY OF

OMAHA, NEBRASKA MEAT-PACKING WASTES

SUMMARY

This report describes and presents the findings of a survey of meat-packing house wastes discharged to the Missouri River at Omaha, Nebraska, during the period November 30 to and including December 12, 1964. The objective of the study was to secure data on the volume and characteristics of the wastes to the Monroe Street and South Omaha sewerage system. An evaluation of the pollution, particularly in terms of coliform bacteria, grease, solids, and oxygen demand, is included because of the decision to continue discharge of paunch manure and accompanying wastes to the city sewers. Grease quantities were measured because of experience of detrimental effects upon downstream water uses, including the St. Joseph, Missouri, municipal water treatment plant. The operation of the Omaha-Missouri River sewage treatment plant was reviewed. Results of the survey are included in summary, Tables I and II.

SUMMARY TABLE I

UNTREATED DISCHARGES TO THE MISSOURI RIVER

LOCATION	Q MGD	Grease #/day	TSS #/day	VSS #/day	BOD #/day	COD #/day	N_2 #/day	Avg. Total Coliform MPN/100 ml	Avg. Fecal Coliform MPN/100 ml
OUTLET Monroe St. Sewer	19.22	89,500	137,600	121,200	168,900	345,210	14,200	21,700,000	14,100,000
OUTLET South Omaha Sewer	3.07	15,910	29,700	25,700	19,400	44,350	1,265	17,850,000	5,333,000
TOTAL	22.29	105,410	167,300	146,900	188,300	389,560	15,465	-	-

SUMMARY TABLE II

OPERATION RESULTS
MISSOURI RIVER TREATMENT PLANT

LOCATION	Q MGD	Grease #/day	TSS #/day	VSS #/day	BOD #/day	COD #/day	N_2 #/day	Total Coliform MPN/100 ml	Total Fecal Coliform MPN/100 ml
Plant Influent	10.23	4,550	17,600	8,950	15,800	33,300	1,320	52,075,000	6,408,000
Plant Effluent	10.23	7,710	1',900	5,860	12,750	23,600	990	33,533,000	5,200,000

CONCLUSIONS

1. Significant quantities of grease are discharged via the Omaha sewerage system to the Missouri River. Grease amounts increased considerably during wet weather conditions.
2. The total suspended solids quantities discharged are meaningful. The maximum daily discharge of the Monroe Street sewer during wet weather flow was 249,000 pounds as compared to a recorded average of 137,600 pounds per day, a ratio of 1.80 to 1. The average figure, which is higher than that used in the sewage treatment plant design, was exceeded five days of the twelve-day sampling period.
3. The recorded values of Biochemical Oxygen Demand show that substantial amounts of waste materials were discharged to the Missouri River. Considerable quantities of solids are being deposited in the sewer during low flow or quiescent periods. Scouring of the material when precipitation occurs results in flushing velocities in the sewer with a resultant discharge highly laden with wastes.

4. Recorded values of total and fecal coliform organisms were high. The effect of the waste discharges upon the Missouri River would be to raise the river coliform values and indicate continued existence of hazardous conditions and their possible effects on downstream water uses.

5. The Missouri River Treatment Plant removal efficiency was below the standard normally accepted for a primary treatment plant. The suspended solids removal averaged 49 percent and the BOD removal averaged about 20 percent. Primary treatment generally removes from 30-40 percent of the BOD and 60-65 percent of the suspended solids.

AUTHORITY

The City of Omaha, Nebraska, initiated a request for assistance in studying the wastes discharged by the meat-packing industry in Omaha, Nebraska (Appendix 1). The request was forwarded to the Water Supply and Pollution Control Program Director of the Public Health Service, Region VI office in Kansas City, Missouri, through the Nebraska Department of Health in Lincoln, Nebraska.

The request came after the second session of a conference which was held on July 21, 1964. The second session determined that the time schedule established for the initiation and completion of adequate waste treatment facilities had not been met.

TIME OF STUDY

The study was conducted from November 30, 1964, to and including December 12, 1964.

PERSONNEL PARTICIPATING IN THE STUDY SURVEY

I. City of Omaha

A. Charles A. Geisler, City Sanitation Engineer

B. James Swan, Sewage Plant Engineer

C. Joe Van Rycheghem, Sewage Plant Foreman

D. Sampling Personnel

II. State of Nebraska

A. Clint Weber, Sanitary Engineer, Nebraska State Department of Health

B. Bill Yant, Nebraska State Department of Health

C. Jim Krebs, Nebraska State Department of Health

III. U. S. Public Health Service

A. Larry Schmidt, Sr. Asst. Sanitary Engineer, Region VI, Kansas City, Missouri

B. Carl Shadix, Chemist, Technical Advisory and Investigations Section, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

C. Daniel J. Weiner, Sanitary Engineering Director, Technical Advisory and Investigations Section, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

D. R. K. Ballentine, Sr. Asst. Sanitary Engineer, Technical Advisory and Investigations Section, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

E. Harry D. Nash, Bacteriologist, Technical Advisory and Investigations Section, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

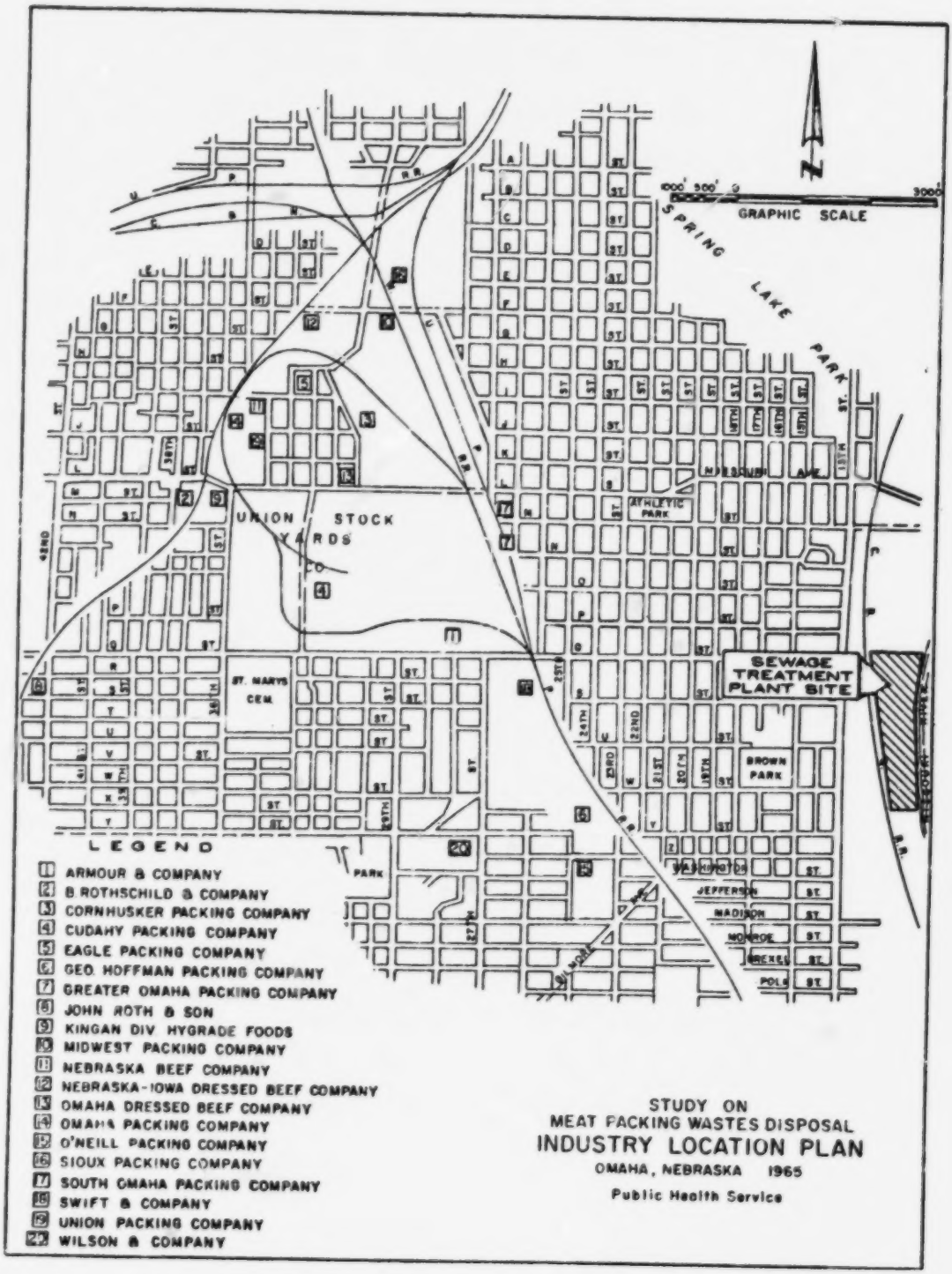
F. Joseph P. Rafferty, Chemist, Technical Advisory and Investigations Section, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio

PURPOSE

To obtain data concerning the sources and amount of wastes material which is being discharged by the meat-packing industry located in Omaha, Nebraska.

STUDY AREA

The meat-packing houses which discharge to the Monroe Street and South Omaha sewers are located in the City of Omaha, Nebraska, in an area known as South Omaha. The site of each meat-packing plant is shown in Figure 1.


N
GRAPHIC SCALE
SPRING LAKE PARK
UNION STOCK YARDS CO.
ATHLETIC PARK
SEWAGE TREATMENT PLANT SITE
ST. MARYS CEM.
BROWN PARK
LEGEND
1 ARMOUR & COMPANY
2 B. ROTHSCHILD & COMPANY
3 CORNHUSKER PACKING COMPANY
4 CUDAHY PACKING COMPANY
5 EAGLE PACKING COMPANY
6 GEO. HOFFMAN PACKING COMPANY
7 GREATER OMAHA PACKING COMPANY
8 JOHN ROTH & SON
9 KINGAN DIV HYGRADE FOODS
10 MIDWEST PACKING COMPANY
11 NEBRASKA BEEF COMPANY
12 NEBRASKA-IOWA DRESSED BEEF COMPANY
13 OMAHA DRESSED BEEF COMPANY
14 OMAHA PACKING COMPANY
15 O'NEILL PACKING COMPANY
16 SIOUX PACKING COMPANY
17 SOUTH OMAHA PACKING COMPANY
18 SWIFT & COMPANY
19 UNION PACKING COMPANY
20 WILSON & COMPANY
STUDY ON
MEAT PACKING WASTES DISPOSAL
INDUSTRY LOCATION PLAN
OMAHA, NEBRASKA 1965
Public Health Service

RAW MATERIALS

Livestock

The beef, pork, and sheep products originate in 24 states in addition to Iowa and Nebraska. Quantities vary with market and consumer demands. Pounds of livestock killed daily are estimated to range as indicated in Table 1.

TABLE 1

	KILL IN #/DAY (LIVE WGT. ON THE HOOF)	
Beef	6,800,000	8,700,000
Hog	2,700,000	4,000,000
Lamb	270,000	540,000

OPERATIONS

Operations vary with the individual packing house; some houses operate 16 to 24 hours per day, five to six days a week. Others operate on an 8 to 16-hour day basis, five to six days per week.

EMPLOYEES

The total number of packing-house employees is about 8,100.

WATER SUPPLY

Water supplied by the Metropolitan Utility District is generally used by the industry. Some packers augment M.U.D. water with water from plant wells. The Union Stockyards Company uses a well field located in

the Missouri River bottoms situated north of the Missouri River sewage treatment plant.

Approximately 13 to 18 mgd of M.U.D. water is used; 5 to 10 mgd of private well water is used.

SEWERS

Packing-house wastes are discharged to the municipal sewerage system. The Monroe Street sewer and South Omaha sewers receive wastes from all but one meat packer, which discharges to the Papillion Creek Treatment Works. Domestic sewage is also discharged to these sewers.

WASTE SOURCES

GREASE

Large quantities of grease are included in waste discharges of floor and equipment wash water, waste material from the carcass dressing, casing cleaning, tripe room, intestines cleaning and handling, and rendering operations.

SUSPENDED SOLIDS

Paunch manure, fecal material from the viscera, floor and equipment wash water, stockpen and stockyard (including stockpen) operations, and livestock truck washings contribute to the suspended solid material discharged to the sewers.

BIOCHEMICAL OXYGEN DEMAND

Most operations connected with the production of meat contribute to the discharge of process liquids and waste waters. The chief sources of BOD are: stockyards, killing floors, carcass dressing, rendering, hide cellar, hog hair removal and processing, casing cleaning, tripe room, laundry, glue, soap, and fertilizer production.

COLIFORM

Coliform bacteria are included in stockyard wastes which contain animal excreta; floor washings from the killing and processing floors.

SANITARY SEWAGE

Sanitary sewage is discharged by approximately 40,000 people in the South Omaha area. An estimated twenty to thirty thousand people discharge their wastes to the South Omaha sewers and the remainder, or 15,600 people, discharge sanitary wastes to the Monroe Street sewer.

In addition to the packing-house wastes, an undetermined number of population equivalents on a BOD basis is discharged by the other industrial and commercial establishments in South Omaha.

SURVEY PROCEDURES

Sample Collection

Plant operations varied with the individual packing houses. Samples were collected twenty-four hours for the packing plants which operated around-the-clock. Otherwise, samples were collected for a twelve or sixteen-hour period. Weather and physical conditions permitting, samples were collected on an hourly basis.

Flow Data

Waste discharges were measured using V-notch and rectangular weirs. At some locations it was necessary to measure the depth of flow

in the sewer at time of sample collection for use in slope-depth calculations of discharges.

A description of the sampling points and flow measuring methods is included in Appendix 3.

Laboratory Analyses

The procedures followed in making determinations are those included in "Standard Methods for the Examination of Water and Wastewater," Eleventh Edition.

Analyses were made for:

1. Grease, by petroleum ether method
2. Total Suspended Solids
3. Volatile Suspended Solids
4. Biochemical Oxygen Demand - 5-day BOD at 20° C.
5. Chemical Oxygen Demand
6. Organic Nitrogen
7. Total Coliform MPN/100 ml
8. Fecal Coliform MPN/100 ml

PRESENTATION OF DATA

WATER USE

According to data received from individual packers and the Union Stockyards Company, water quantities received from the mud water system may range from 13.0 mgd to over 18.0 mgd. In addition, private industrial wells produce from 5.0 to 10.0 mgd for use in the plants. Water requirements vary seasonally.

WASTES CONTRIBUTED

According to data for the period November 30 to December 6, 1964, flows ranged from 10.3 - 19.5 mgd in the Monroe Street sewer; 1.5 - 3.0 mgd from the South Omaha Street sewer; and the flow to the sewage treatment plant ranged from 7.6 to 8.8 mgd.

From December 7 to completion of sampling operation on December 12, 1964, the Monroe Street outfall sewer discharges ranged from 17.3 to a maximum amount of 26.2 mgd.

During the same period, discharges from the South Omaha sewer varied from 3.1 - 5.0 mgd, and the inflow to the sewage treatment plant ranged from 11.5 to 13.4 mgd.

Results of the sampling and analytical work are presented in Tables 2, 3 and 4. Individual packing-house results are included within Appendix 4, Table 1.

Table 2
Results of Analyses
Monroe St. Sewer

Date	Q MID	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
11/30	-	-	-	-	-	-	-	-	-	-	-	-	-
12/1	24.8*	310	64,200	1,930	400,000	72.8	15,100	944	195,500	874	181,000	896	185,300
12/2	18.74	412	64,500	2,030	318,000	-	-	784	122,800	736	115,300	776	121,200
12/3	19.35	613	99,000	-	-	-		1,244	201,000	1172	189,000	1080	174,200
12/4	19.45	628	102,000	-	-	-		548	89,000	520	84,500	1010	167,200
12/5	13.45	444	49,800	-	-	-		668	75,000	614	69,000	834	93,700
12/6	10.30	175	15,050	720	61,900	28.8	2,480	292	25,100	240	20,600	330	28,300
12/7	22.75	482	91,500	1,760	334,000	78.6	14,950	904	171,800	764	145,000	1000	189,800
12/8	22.40	581	109,000	1,160	217,000	110.8	20,700	832	155,800	712	133,200	1320	246,300
12/9	20.80	458	79,500	2,280	396,000	88.6	15,400	744	129,000	624	108,300	1120	194,000
12/10	26.15	1108	241,500	3,000	655,000	91.6	20,000	1,140	249,000	950	207,500	1420	305,000
12/11	20.80	465	80,800	2,020	355,000	73.6	12,800	750	130,300	623	108,200	982	170,300
12/12	17.30	537	77,600	2,560	370,000	84.6	12,200	740	107,000	640	92,500	1050	151,400
Average	19.22	518	39,500[1]	1,940	345,210[2]	78.7	14,200[3]	799	137,610[4]	706	121,175[5]	983	168,892

1) Excl. 12/6 - Sunday - Average = 96,310
2) " " " Average = 380,625
3) " " " Average = 15,880
4) " " " Average = 148,740
5) " " " Average = 130,300

* Flow measured for part of day.

14-4

Table 3
Results of Analyses
South Omaha Sewer

Date	Q MGD	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
11/30	-	-	-	-	-	-	-	-	-	-	-	-	-
12/1	2.99	358	8,940	1,220	30,450	52.6	1,310	704	17,570	592	14,800	764	19,000
12/2	2.83	615	14,500	2,270	53,600	-	-	1,360	32,100	1,332	31,500	858	20,300
12/3	2.84	293	6,950	-	-	-	-	652	15,480	604	14,300	634	15,000
12/4	2.94	853	20,950	-	-	-	-	1,556	38,200	1,510	37,100	776	19,000
12/5	2.21	626	17,550	-	-	-	-	712	13,130	632	11,670	540	9,900
12/6	1.46	94	1,150	450	5,490	13.1	160	312	3,810	244	2,980	144	1,750
12/7	3.14	13,520	354,200*	780	20,430	59.0	1,550	2,784	73,000	2,660	69,750	1,120	29,300
12/8	3.21	281	7,540	1,810	48,500	51.8	1,390	1,276	34,200	1,088	29,150	766	20,750
12/9	3.33	590	16,400	2,120	58,900	50.0	1,390	828	23,000	712	19,800	1,000	27,750
12/10	4.96	305	12,650	1,120	46,400	38.4	1,590	1,028	42,600	560	23,200	460	19,000
12/11	3.33	288	8,000	1,240	34,500	39.4	1,095	704	19,560	532	14,800	542	15,000
12/12	3.59	1,720	51,600	3,360	100,900	54.4	1,630	1,440	43,200	1,300	39,000	1,220	36,300
Average	3.07	1,628	15,910	1,600	44,350	44.8	1,265	1,113	29,654	980	25,670	735	19,422

* Not Used in Average.

14 C

Table 4
Operational Results
Missouri River
Sewage Treatment Plant

Date	Q MGD	Raw Grease mg/l	Raw Grease #/day	Effluent Grease mg/l	Effluent Grease #/day	Raw COD mg/l	Raw COD #/day	Effluent COD mg/l	Effluent COD #/day	Raw Organic Nitrogen mg/l	Raw Organic Nitrogen #/day	Effluent Organic Nitrogen mg/l	Effluent Organic Nitrogen #/day
11/30	-	-	-	-	-	-	-	-	-	-	-	-	-
12/1	7.9	-	-	-	-	540	35,600	410	27,050	22.0	1452	17.9	1180
12/2	8.6	28	2010	138	9910	460	33,050	400	28,750	-	-	-	-
12/3	8.3	53	3670	44	3050	-	-	-	-	-	-	-	-
12/4	8.8	57	4190	36	2645	-	-	-	-	-	-	-	-
12/5	7.9	57	3760	44	2900	-	-	-	-	-	-	-	-
12/6	7.6	69	4380	734	46500	250	15,870	190	12,050	6.0	381	5.4	342
12/7	11.5	77	7390	30	2880	310	29,800	210	20,200	15.4	1480	12.6	1210
12/8	12.2	64	6520	33	3360	450	45,800	330	33,600	14.9	1520	12.9	1315
12/9	12.0	57	5710	33	3310	480	48,100	350	35,100	16.6	1665	12.4	1242
12/10	11.2	43	4020	27	2525	310	29,000	140	13,100	12.6	1180	11.4	1068
12/11	13.4	63	7050	41	4590	260	29,100	170	19,000	12.9	1445	10.0	1200
12/12	12.6	49	5150	30	3160	-	-	-	-	13.5	1420	3.3	347
Average	10.23	56	4550	108	7710	380	33,290	290	23,610	14.2	1320	10.7	988

142

Table 4
Operational Results
Missouri River
Sewage Treatment Plant
(Cont'd.)

Date	Q MGD	Raw Total Sus. Solids mg/l	Raw Total Sus. Solids #/day	Effluent Total Sus. Solids mg/l	Effluent Total Sus. Solids #/day	Raw Vol. Sus. Solids mg/l	Raw Vol. Sus. Solids #/day	Effluent Vol. Sus. Solids mg/l	Effluent Vol. Sus. Solids #/day	Raw BOD mg/l	Raw BOD #/day	Effluent BOD mg/l	Effluent BOD #/day
11/30	-	-	-	-	-	-	-	-	-	-	-	-	-
12/1	7.9	270	17,800	120	7,920	222	14,650	74	4,880	323	21,250	254	6,700
12/2	8.6	192	13,800	85	6,100	160	11,500	68	4,880	236	16,900	223	16,000
12/3	8.3	148	10,260	94	6,520	118	8,180	77	5,340	346	23,950	226	15,650
12/4	8.8	142	10,430	71	5,220	112	8,240	60	4,410	214	15,700	189	13,900
12/5	7.9	134	8,850	76	5,020	106	7,000	62	4,090	139	9,150	104	6,900
12/6	7.6	102	6,480	52	3,300	86	5,450	45	2,860	94	5,960	82	5,250
12/7	11.5	232	22,300	87	8,350	168	16,150	71	6,820	173	16,600	132	12,650
12/8	12.2	203	20,700	96	9,780	153	15,600	74	7,550	162	16,500	173	17,600
12/9	12.0	166	16,620	91	9,110	130	13,030	77	7,710	191	19,100	166	16,600
12/10	11.2	470	44,000	253	23,650	206	19,270	101	9,440	156	14,600	90	8,400
12/11	13.4	246	27,550	150	16,800	125	14,000	67	7,500	156	14,800	122	13,630
12/12	12.6	121	12,750	53	5,580	92	9,680	46	4,850	148	15,550	112	11,750
Average	10.23	202	17,630	102	8,946	140	11,896	68	5,861	195	15,800	156	12,920

DISCUSSION OF RESULTS

Eighteen meat packers discharge industrial and sanitary wastes to the Monroe Street and South Omaha sewers. The Union Stockyards Company sewers discharge wastes to the Monroe Street sewer, which receives the wastes of the Armour Company, George Hoffman Packing Company, Cudahy Packing Company, O'Neill Packing Company, Swift and Company, and Wilson and Company plants. The other plants which discharge their wastes to the South Omaha sewer include: Cornhusker Packing Company, Eagle Packing Company, Greater Omaha Packing Company, Hygrade Food Products Division, Midwest Packing Company, Nebraska Beef Company, Nebraska-Iowa Dressed Beef Company, Omaha Dressed Beef Company, Omaha Packing Company, Rothschild and Company, Sioux Packing Company, and Union Packing Company.

GREASE

Large quantities of grease are discharged to the Missouri River through the Monroe Street and South Omaha sewers daily. Quantities vary, depending upon the hydraulic conditions in the sewers. Flushing of the sewers during wet weather increased the amount of grease discharged.

The Monroe Street sewer discharged an average of 65,150 pounds of grease daily during the first week of the study, and 113,300 pounds daily during the second week. The maximum grease discharge occurred on December 10, 1964, when 241,500 pounds was recorded.

For the same two-week period, an average of 15,910 pounds per day of grease was discharged and recorded for the South Omaha sewer. This average does not reflect the excessively high value of 354,200 pounds of grease reported for December 7, 1964.

From both the Monroe Street and South Omaha sewers, the total amount of 105,410 pounds/day greatly exceeds the original or initial waste grease estimate. Most of the grease is escaping from the packing plants; in addition, limited quantities of grease are being wasted from residences and other industrial and commercial establishments.

SUSPENDED SOLIDS

The total suspended solids value of 167,300 pounds/day reflects the average suspended solid load from both sewers. During the survey period, higher figures were recorded on five different occasions. Values ranged from 155,000 - 249,000 pounds/day. Precipitation occurred in the period, and the runoff accounts for the scouring of settled solids and the added discharge. Coincidentally, the greatest waste solids load occurred during December 10, 1964, the day of the greatest precipitation.

VOLATILE SUSPENDED SOLIDS

The volatile suspended solids content of the Monroe Street and South Omaha sewers shows a predominant characteristic of meat industry

wastes. The volatile suspended solids are about 85 percent that of the total suspended solids. On the other hand, the South Interceptor flow to the Missouri River Plant included discharges in which volatile suspended solids averaged about 67 percent. In general, the quantity of suspended solids discharged was high from the Monroe Street and South Omaha sewers, and was due to the discharge of packing-house wastes to the sewers.

BIOCHEMICAL OXYGEN DEMAND (BOD)

A combined total of 188,300 pounds per day of BOD was measured for the Monroe Street and South Omaha sewers. The average value of 168,900 pounds per day discharged through the Monroe Street outfall was exceeded on December 8 and December 10, 1964, when figures of 246,300 and 305,000 pounds were recorded.

Precipitation during the preceding week had resulted in increased flows to the sewers. Additional flow increased the hydraulic loading on the Monroe Street sewer. Overflow diversion to the south barrel occurred. A maximum flow of 26.2 mgd occurred, with a maximum BOD load of 305,000 pounds/day. This value demonstrates and confirms the phenomenon that occurswithin the sewer; namely, sedimentation within the Monroe Street sewer in reaches below the 25th and "Z" Street location.

High BOD values, due to the accumulation of waste in the sewer behind the weir, were recorded at this sampling location during the week of sampling. Reduction occurred between the point of sampling and the outlet of the Monroe St. sewer due to the deposition of wastes.

The same type of phenomena occurred in the South Omaha system. It is noteworthy that grease was collected in the latter system at weirs constructed by "entrepreneurs," who recovered grease from the sewer for sale. It is more than probable that the damming effect of these weirs resulted in continued sedimentation of solids material. Grease accumulations occurred over a long period of time when the more or less quiescent conditions existed.

CHEMICAL OXYGEN DEMAND (COD)

The chemical oxygen demand (COD) values indicate that a great amount of material is present in the wastes that can be oxidized more readily chemically, but not as readily biochemically. COD values were more than twice the BOD values.

ORGANIC NITROGEN

The nitrogen values based upon analytical data for wastes discharged by meat-packing houses to the Monroe Street and South Omaha sewerage systems averaged several times the nitrogen values of the South Interceptor wastes. The nitrogen concentrations were as expected for a sewerage system which serves an industrial complex composed mainly of meat-packing houses.

COLIFORM

The MPN/100 ml values for both total and fecal coliform showed that large quantities of material from the lower intestinal tracts of animals were being discharged to the sewerage system. It is estimated that at Omaha, the Missouri River total coliform counts would be increased by these contributions by a value of about 80,000 - 90,000 MPN/100 ml.

SEWAGE TREATMENT PLANT EFFICIENCY

Summary Table II summarizes the operation of the sewage treatment plant. During the study period, the plant reduction of BOD averaged about 20 percent. For solids, the average removal efficiency was approximately 49 percent. Grease removal in the primary clarifiers varied considerably. In general, the performance of the plant was below the accepted standards for a primary treatment plant.

Thirty to 35 percent removal of the raw BOD by plain sedimentation facilities is acceptable. Suspended solids removal efficiency in primary tanks ranges from 50 to 75 percent, with an average of 60 percent. Bacteria removal efficiencies in primary plants reach as high as 75 percent; 50 percent is acceptable in practice.

In general, the data for the South Omaha sewer presented in Summary Table I were more or less confirmed by a recapitulation of the data gathered for individual packers in the period December 7 - 12, 1964 inclusive. Of necessity, estimates of data were made for those plants for which it was not possible to carry out a sampling and analytical program. Such estimates were made on a comparative kill basis.

The figures are presented in Table 5.

TABLE 5

SOUTH OMAHA DATA PERIOD
(December 7 to 12, 1964)

	Grease #/day	Suspended Solids Total #/day	Suspended Solids Volatile #/day	COD #/day	N_2 #/day	BOD #/day
Actual	19,240	39,260	32,616	51,605	1441	24,680
Recapitulation*	19,000	34,806	32,627	58,386	1297	25,500

* Summation of data gathered for individual packers who discharge to South Omaha Sewer System.

Existing treatment facilities and the units now in planning and design phases are based upon the normal removal of suspended solids (and attendant BOD) to provide Omaha primary treatment.

Historically, in the Lower Missouri River Basin Water Pollution Investigation Report October 1952, it has been recorded that the dissolved oxygen concentrations dropped below the 5.0 ppm level at stations located at Bellevue, Plattsmouth, Nebraska City, and Brownsville, Nebraska, and at St. Joseph, Missouri.

Consideration should be given to the dissolved BOD which is not removed by primary facilities. This dissolved BOD and non-settleable suspended solids would have to be removed by secondary or biological units. When the discharged wastes reach such magnitudes that dissolved oxygen depletion below Omaha becomes a waste problem in the Missouri River, Omaha may then be in a position to consider installation of secondary treatment facilities.

The study demonstrated the effect of wet weather flow upon the amount of wastes discharged. Bypassing the excessive flows increases the waste load because of the flushing action of the higher flows and increased velocities. During normal plant operation wet weather flows in excess of the three-to-one bypass ratio would be discharged to the river untreated. It is probable that the amount of waste material would materially exceed the quantities used as a basis of design, particularly with the added quantities of paunch manure and associated wastes. Grease and BOD values recorded during this study point to the need for improved, continued good housekeeping practices within the meat-packing industry.

APPENDICES

CITY OF OMAHA
EXECUTIVE OFFICE
JAMES J. DWORAK, MAYOR

November 30, 1964

cc: DWSPC, Attn: Stein
DWSPC, Attn: Krause
PHS SEC, ATTN: DeMartini
PHS SEC, Attn: Kittrell
Nebr State Dept.Health,
Dr. Rogers (2)
(Fwd by PHS Reg VI,12/7/64)
mc

Mr. Herbert C. Clare
U. S. Public Health Service
[illegible] Westport Road
Kansas City, Missouri 64111

Through Mr. T. A. Filipi - - Nebraska State
Department of Health

Dear Mr. Clare:

Because of the vastness of the packing house industry in Omaha, the largest in the nation, the City of Omaha's problem of abating pollution of the Missouri River is more than ordinarily complex. The effectiveness of corrective measures is dependent on knowledge of the sources and quantity of pollution. Extensive and exacting testing is required to obtain this knowledge.

The City can provide manpower for the tests but requires technical assistance in training of the personnel for setting up the sampling stations, in the taking of samples, and in making the chemical and bacteriological analysis.

The City of Omaha, therefore, appeals to the Public Health service for the technical assistance and supervision required to carry out a testing program. The successful completion of such a program will be very helpful to the City in its continuing battle to abate pollution of the Missouri River and to meet the Federal standards prescribed therefor.

Your help will be greatly appreciated.

Reproduced from best available copy.

Very truly yours,

James J. Dworak

JAMES J. DWORAK
Mayor

cc: Construction Grants Section
Enforcement Section
12/3/64 vgc

Forwarded to Mr. H. C. Clare, Public Health Service, on December 2, 1964.

T. A. Filipi

WE TEST NEARLY EVERYTHING UNDER THE SUN

Omaha Testing Laboratories

511 So. 20th Street
Omaha, Nebraska 68102

January 21, 1965

Report Number
A 9512

Report made for
City of Omaha
South Omaha Sewage Treatment Plant
5600 South 10th Street
Omaha, Nebraska
Attn: Mr. M. A. Geisler

Report on
Analysis of Sewage Sample submitted 15 January 1965.

The submitted sample was separated into three portions: the first was tested as received, the second was tested after removing the settleable solids, and the third was aerated by bubbling air through it for thirty minutes before testing.

Test Results:

Condition	5 day B.O.D.
As received	620 p.p.m.
After removing Settleable Solids	630 p.p.m.
After aeration	640 p.p.m.

No. B.O.D. [illegible] over the solids after Settlement

OMAHA TESTING LABORATORIES

By L. G. Erickson
L. G. Erickson, P.E.
Chief Engineer

LGE/erc

Reproduced from best available copy.

Note 1. Flow at downstream Swift's at time when samples were taken was 20"

2. Colored balls were dropped in sewer at Combustion sample point.
Three red balls dropped at 10:00 - - - - 1 ball observed at 10:54
" blue " " " at 10:25 - - - - 0 " "
continued observation until 11:20 no balls showed up

25

CERTIFICATE

GTL General Testing Laboratories
CHEMICAL AND PHYSICAL TESTING
PHONE GRand 1-1205 1517 WALNUT ST., KANSAS CITY, MO.

Date December 4, 1964 Number 20070

Sample of Water - Missouri River

Marked Starting 11-16-64 8:30 a.m. - Ending 11-17-64 7:30 a.m.

Submitted by St. Joseph Water Company

Grease Content	---	8.0 ppm

Respectfully submitted

GENERAL TESTING LABORATORIES, INC.

By _____

Manager

CERTIFICATE

General Testing Laboratories
CHEMICAL AND PHYSICAL TESTING
PHONE GRand 1-1205 1517 WALNUT ST., KANSAS CITY, MO.

Date January 5, 1965 Number 21833

Sample of Water - Missouri River

Marked Starting 12/29-64 8:30 a.m. to 12/30-64 7:30 a.m.

Submitted by Missouri Water Pollution Board (St. Joseph Water Co.)

Grease Content	---	3.2 ppm

Respectfully submitted

GENERAL TESTING LABORATORIES, INC.

By _____
Manager

CERTIFICATE

General Testing Laboratories
CHEMICAL AND PHYSICAL TESTING
PHONE GRand 1-1205 1517 WALNUT ST., KANSAS CITY, MO.

Date January 11, 196 5 Number 21973

Sample of Water

Marked Collected on the basis of 10 M.G. per MID rate each hour. From 12:30 a.m. to 11:30 p.m. 1-5-65

Submitted by Missouri Water Pollution Board (St. Joseph Water Co.)

Grease Content	---	1.2 ppm

Respectfully submitted

GENERAL TESTING LABORATORIES, INC.

By _____

Manager

28

INDUSTRIAL TESTING LABORATORIES inc.

1828 Hadley Street • St. Louis 6, Missouri

Chemists
Engineers
Metallurgists

CHestnut 1-8837

ALLAN M. SIEGEL, Director

Report No. 10-10-261 October 29, 1964

Examination of fat samples submitted.

Water Pollution Board
State of Missouri
Jefferson City, Missouri

Attn: Mr. [illegible]
Executive [illegible]

TEST REPORT

from St. Joseph Water Plant

Sample	Identification
10-16 Screen	Animal Fat
10-18 Screen & No. 1 Basin	Animal Fat
10-17 Screen & No. 1 Basin	Animal Fat
10-20 Screen & No. 1 Basin	Animal Fat
10-22 Screen & No. 1 Basin	Animal Fat

Respectfully submitted,

INDUSTRIAL TESTING LABORATORIES, INC.

Allan M. Siegel

Allan M. Siegel, Director

APPENDIX 3

STUDY OF

OMAHA, NEBRASKA MEAT-PACKING WASTES

SAMPLING POINTS

1. UNION PACKING COMPANY

The weir was located in the manhole beside the front steps of the company office. A deflector was constructed to direct flow down to sewer bottom so that a weir could be installed. A one and one-half foot rectangular weir was installed.

2. CUDAHY PACKING COMPANY

The sampling manhole was located beside the track approximately 100 feet east of the clarifier. The manhole is about 13 feet deep. The diameter of the sewer is 30 inches and the slope is 0.0107 ft. The flow was measured by determining depth of flow.

3. ARMOUR COMPANY

The clarifier is sampled from a manhole located at east base of clarifier. The flow was measured at the clarifier effluent weir, a sharp-edged weir 15 feet long with no end contractions. Flow containing paunch manure, etc., was sampled at the manhole between the railroad tracks (approximately 50 feet west of the southwest corner of the clarifier). The manhole is 17 feet deep. The sewer diameter is 18 inches and the slope is 0.0140 ft./ft.

A-3

4. SWIFT & COMPANY

Upstream - The manhole is located beside the old scale platform just south of the guardhouse. The manhole is 20 feet deep. The sewer was "Gunited" in the late fifties, and now has a diameter of 7 feet, 4 inches. The slope of the sewer is approximately .0047 ft./ft. Based on Price Current Meter readings taken in sewer, an N value of about .023 was approximated.

5. SWIFT & COMPANY

Downstream - The manhole is located near the Simon Wholesale building in the vicinity of the Hoffman Packing Company, south approximately 75 feet from southwest corner of the Simon Building. The sewer diameter is 8 feet, 9 inches. A 6-foot rectangular weir was installed.

6. O'NEILL PACKING COMPANY

The weir was located in the manhole at the intersection of "Z" Street and 25th Street, several feet from the east curb. A one-foot rectangular weir was installed.

7. WILSON AND COMPANY

Flow was measured at the clarifier at the 4-foot rectangular weir (no end contractions). The remainder of the flow was measured in the manhole by a 1-foot rectangular weir. The manhole is located several hundred feet east of the clarifier.

8. MONROE STREET SEWER OUTFALL

The 8-foot diameter sewer has a slope of 0.02350 ft./ft. Flow was measured by determining depth of flow at outfall.

9. SOUTH OMAHA SEWER

This outfall sewer consists of twin barrels, 11 feet, 11 inches in width. Identical rectangular weirs were installed; these are 30 inches wide and can handle a head of 12 inches. The crest is 15 inches off the sewer floor.

10. ROTHSCHILD AND COMPANY

The sampling manhole is located approximately 75 feet south, southeast of the southeast corner of the plant. A 90-degree V-notch weir was installed.

11. HYGRADE FOOD PRODUCTS DIVISION

This manhole is located west of the plant alongside the railroad tracks. A weir box was constructed. The sewer was extended into this box and a one-foot removable rectangular weir was installed.

12. OMAHA PACKING COMPANY

This weir is located in a manhole located in the driveway to the north end of the plant. The manhole is 8 feet deep. The weir was installed as a 90-degree V-notch.

13. NEBRASKA BEEF COMPANY

This manhole is located at the northeast corner of the plant and on the north side of the fence by the power transformers. The weir is a 90-degree V-notch.

A-3

14. NEBRASKA-IOWA DRESSED BEEF COMPANY

The manhole is located west of the plant approximately 100 feet and 5 feet north of the tracks.

15. CORNHUSKER PACKING COMPANY

This manhole is located about 15 feet off Dahlman Avenue on the west side of the road. It is several hundred feet south of the intersection of "H" Street and Dahlman. A 90-degree V-notch weir was constructed.

16. MIDWEST PACKING COMPANY

The sampling manhole is located about 20 feet due east of the plant. A 90-degree V-notch weir was constructed in the center of the manhole.

17. SIOUX PACKING COMPANY

This manhole is located south of the plant and is directly under the "F" Street viaduct and about 5 feet east of the tracks. A 90-degree V-notch weir was constructed at a point just prior to where it entered a 28-inch sewer.

18. GREATER OMAHA PACKING COMPANY

Upstream - The sampling point is located in the manhole between the Nixon elevator and railroad tracks. A 90-degree V-notch weir was installed about a foot above sewer bottom.

19. GREATER OMAHA PACKING COMPANY

Downstream - The sampling point was located in the manhole under "Q" Street viaduct and about 20 feet east of the railroad tracks. A one-foot rectangular weir was installed.

A-4

Table 1
Analytical Results

Date	Q MGD	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant I													
11/30	1.31	-	-	-	-	48.4	489	536	5430	-	7000 *	907	9150
12/1	1.53	-	-	1430	18,360	5.7	73	800	10280	738	9430	1240	15810
12/2	1.55	569	7360	8170	98,160	-	-	1180	14300	1084	14490	982	12685
12/3	1.59	-	-	-			-	539	7060	508	6750	558	7390
12/4	1.70	531	7540	-	-	-	-	740	10500	708	10050	1250	16690
12/5	0.91	-	-	-		-	-	616	4680	448	3950	936	7200
12/6	0.35	19	56	810	953	13.4	17	479	569	355	445	119	140
Average	1.23	373	4975	1470	29,190	20.5	281	688	7568	637	7979	841	9795 (1)

(1) Average 11,400 excluding Sunday, 12/6/64. * Assumed

Industrial Plant II													
11/30	0.57	-	-	-	-	80.5	384	1368	5890	-	5100 *	530	9975
12/1	0.54	-	-	1710	7,790	0.6	3	2342	10580	2310	10600	877	3990
12/2	0.62	2047	10600	3460	12,750	-	-	2736	14150	2648	13730	444	8510
12/3	0.63	468	2440	-		-	-	1180	6010	1064	5600	968	5080
12/4	0.66	425	2340	-	-	-	-	1950	10800	1739	9550	918	5050
12/5	0.25	-	-	-	-	-		608	1170	598	1140	342	650
12/6	0.04	-	-	660	220	21.6	7	270	90	98	33	137	45
Average	0.46	979	5127	1610	10,075	36.9	198	1498	6983	1407	6599	602	3765 (1)

(1) Average 3,290 excluding Sunday, 12/6/64. * Assumed

Industrial Plant III													
11/30	0.4	-	-	-	-	-	-	896	2995	-	2590 *	1230	4100
12/1	0.4	5899	20000	-	-	-	-	1845	5500	1590	5310	1740	6575
Average		5899	20000	-	-	-	-	1370	4247	1590	4100	1485	5338
* Assumed													

Industrial Plant IV													
11/30	10.2	-	-	1370	116,700	57.1	4960	428	36400	-	-	857	72905
12/1	11.2	535	50000	1930	143,000	44.8	6250	836	80000	816	76400	827	70951
12/2	11.9	-	-	-	-	-	-	466	54100	430	48900	624	72338
12/3	11.2	-	-	-	-	-	-	1044	125000	980	114000	776	86408
12/4	11.9	-	-	-	-	-	-	840	81500	776	77100	806	79959
12/5	6.6	531	29250	-	-	-	-	998	55000	942	51900	684	37630
12/6	4.8	-	-	900	13,040	187	5100	109	4375	93	3750	258	6325
Average	10.8	533	39625	1070	129,860	81.3	5505	677	70667	673	65550	577	60710*

* Average 69,780 excluding Sunday, 12/6/64.

Table 1
Analytical Results
(Cont'd.)

Date	Q MGD	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant V													
11/30	18.7	-	-	1680	806,300	1.9	733	8976	369,000	-	351,000*	930	401,756
12/1	16.7	-	-	2050	314,000	67.4	9400	5476	1,182,000	5324	1,169,000	1270	195,883
12/2	16.7	-	-	-	-	-	-	7076	1,015,000	7124	994,000	2160	300,840
12/3	17.5	-	-	-	-	-	-	3580	578,500	3830	560,000	4000	291,900
12/4	16.9	-	-	-	-	-	-	1648	893,000	1596	816,000	1860	251,300
12/5	10.8	1846	166,500	-	-	-	-	2748	248,000	2648	239,000	2150	194,357
12/6	7.1	150	8,900	550	32,800	25.4	1508	1473	87,500	1398	82,900	285	16,817
Average	14.24	998	166,500	1490	380,150	31.6	5815	4073	567,583[1]	4253	430,000[2]	1720	190,836

1) Operating days only used for average. (490,900 average for 7-day week).
2) Operating days only used for average. (372,130 average for 7-day week).
* Assumed

Date	Q MGD	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant VI													
11/30	0.34	-	-	8750	9940	110.5	314	3126	8,860	-	8,630*	1320	3,740
12/1	0.38	-	-	8175	6990	44.2	143	1650	5,350	1580	5,040	732	2,320
12/2	0.40	1754	5,840	-	-	-	-	2034	6,960	2004	6,700	644	2,150
12/3	0.60	-	-	-	-	-	-	772	3,865	712	3,565	496	2,480
12/4	0.44	-	-	-	-	-	-	2368	8,700	2300	8,450	910	3,370
12/5	0.39	-	-	-	-	-	-	979	3,160	896	2,880	578	1,875
12/6	0.06	-	-	170	85	1.9	1	90	45	90	45	55	28
Average	0.37	1754	5,840	1700	7365	52.2	289	1588	6,149	1265	5,890	676	2,650**

* Assumed
** Operating days only used for average. (8656 average for 7-day week).

Date	Q MGD	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant VII													
11/30	2.04	-	-	1750	30,000	-	-	484	7,210	-	6,460 *	944	15,980
12/1	1.74	768	11,180	2250	34,100	83.4	1210	568	9,700	610	8,860	1100	15,950
12/2	1.55	947	7,080	-	-	98.8	1800	668	8,650	660	8,550	1080	13,950
12/3	1.51	2588	30,100	-	-	-	-	1540	19,400	1479	18,600	1280	15,100
12/4	1.58	544	7,160	-	-	-	-	780	9,500	696	8,950	944	12,490
12/5	1.04	513	4,450	-	-	-	-	508	4,410	468	4,060	804	6,970
12/6	0.77	-	-	780	5,080	36.8	237	168	1,082	148	1,080	398	2,550
Average	1.46	912	13,994	1630	23,707	73.0	882	670	8,599	674	8,068	964	12,855

* Assumed.

Table 1
Analytical Results
(Cont'd.)

Date	Q MGD	Irgan mg/l	Irgan #/day	VSS mg/l	VSS # (a)	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant VIII													
11/30	1.62	-	-	9510	34,000	57.6	780	1158	15,650	-	19,150 *	1420	19,200
12/1	1.64	-	-	-	-	-	-	1268	19,500	1260	19,360	-	-
12/2	1.73	-	-	-	-	-	-	1509	21,700	1434	20,700	1300	18,780
12/3	1.91	-	-	-	-	-	-	1268	20,200	1216	19,400	1460	23,530
12/4	1.76	842	12,300	-	-	-	-	1460	21,700	1408	20,900	1290	19,150
12/5	0.81	-	-	-	-	-	-	5784	39,100	5598	37,800	3716	25,080
12/6	0.39	269	875	890	2,900	44.0	143	896	2,980	818	2,660	478	1,550
Average * Assumed	1.44	555	6,688	1700	34,300	50.8	780	1908	20,152	1955	19,484	1613	17,860
Industrial Plant IX													
11/30	2.49	-	-	1890	26,000	40.1	834	454	9,440	-	8,740 *	427	8,870
12/1	2.67	-	-	1440	19,100	46.8	1040	486	10,820	434	9,660	440	9,790
12/2	2.45	269	5,100	-	-	-	-	279	5,560	264	4,990	342	6,975
12/3	2.73	-	-	-	-	-	-	189	4,150	144	3,280	184	4,185
12/4	2.62	-	-	-	-	-	-	276	6,130	258	5,600	263	5,855
12/5	2.84	-	-	-	-	-	-	334	7,490	286	6,780	334	7,500
12/6	0.90	-	-	190	1,430	6.1	46	134	1,010	140	1,050	796	600
Average * Assumed	2.39	269	5,100	960	29,000	31	937	309	6,366	850	5,768	898	6,368
Industrial Plant X													
12/7	0.57	447	2,130	1420	6,660	55.8	866	680	8,250	584	8,780	714	3,460
12/8	0.483	350	1,410	2120	8,460	80.0	320	768	3,080	696	8,810	736	3,770
12/9	0.530	-	-	3800	14,180	79.6	353	1068	4,710	1008	4,460	848	3,660
12/10	0.586	-	-	5000	24,920	111.4	546	2480	11,190	2190	10,760	1160	5,670
12/11	0.564	-	-	2680	12,130	86.6	408	1016	4,980	968	4,460	796	3,760
12/12	Neg.	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.54	350	1,770	2660	13,288	80.7	379	1149	5,360	1085	5,050	851	4,060

Table 1
Analytical Results
(Cont'd.)

Date	Q MGD	Phenols mg/l	Phenols #/day	BOD mg/l	BOD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Tot. Dis. Solids mg/l	Tot. Dis. Solids #/day	TOC mg/l	TOC #/day
Industrial Plant XI													
12-7	0.043	1891	471	3740	1400	125.4	40	9730	1038	8630	4112	1440	525
12-8	0.371	1440	657	2330	1364	73.8	43	1640	779	1140	914	1010	937
12-9	0.042	-	-	2140	691	18.2	29	446	887	340	190	466	196
12-10	0.046	-	-	4460	1726	46.0	16	2939	1196	2610	1303	1240	488
12-11	0.0575	-	-	-	-	-	-	-	-	-	-	-	-
12-12	0.913	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.346	1312	464	2770	1245	59.9	32	2013	543	1843	779	1018	489
Industrial Plant XII													
12-7	0.241	4288	9500	3620	17,350	111.4	23	4830	6110	3860	7910	2610	5,240
12-8	0.208	1754	3053	5800	12,310	123.2	21	7661	13,330	7430	12,900	3160	5,725
12-9	0.163	-	-	-	-	-	-	-	-	-	-	-	-
12-10	0.162	-	-	-	-	-	-	-	-	-	-	-	-
12-11	0.124	-	-	4280	4,790	135.2	180	2860	2340	2500	2070	1280	1,377
12-12	0.136	-	-	4190	4,900	98.4	112	1960	2890	1690	2061	1130	1,475
Average	0.172	2994	5760	4030	9,718	118.1	69	3993	6934	3784	6811	1840	2,964
Industrial Plant XIII													
12-7	0.128	-	-	3640	3,820	82.4	88	2372	2533	2280	2440	1300	1,380
12-8	0.186	-	-	2400	2,565	77.0	82	1400	1496	1300	1390	757	810
12-9	0.136	692	785	-	-	-	-	-	-	-	-	-	-
12-10	0.171	330	471	-	-	-	-	-	-	-	-	-	-
12-11	0.115	-	-	2660	2,750	65.0	68	2180	2036	1980	1900	531	510
12-12	0.055	-	-	1280	588	44.0	20	515	236	495	227	572	263
Average	0.122	511	628	2300	2,180	67.1	63	1602	1576	1514	1489	766	716

Table 1
Analytical Results
(Cont'd.)

Date	Q MGD	Grease mg/l	Grease #/day	BOD mg/l	BOD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant XIV													
12-7	0.177	-	-	-	-	-	-	-	-	-	-	-	-
12-8	0.125	-	-	-	-	-	-	-	-	-	-	-	-
12-9	0.151	-	-	7760	10,950	184.1	239	3450	4460	3080	4250	2600	3,360
12-10	0.257	-	-	3500	7,710	94.3	181	1412	3025	1195	2565	1040	2,235
12-11	0.136	387	194	4400	11,500	94.6	213	1675	3940	1545	3110	1300	2,990
12-12	0.271	1969	3540	518	11,600	101.8	219	1771	4015	1670	3760	1711	3,890
Average	0.249	1377	2740	136	10,665	117.1	241	2077	4359	1978	3936	1664	3,458
Industrial Plant XV													
12-7	0.0141	-	-	4430	374	248.	29	2000	348	2774	333	2130	251
12-8	0.0225	-	-	18,400	2,50	185.	21	7150	1,0	6540	1870	6900	7,1
12-9	0.0307	13	3	11,700	2920	271.	2	4300	660	4030	968	3500	9,1
12-10	0.0240	-	-	4,440	1475	125.2	43	2460	518	1960	468	1770	990
12-11	0.0285	-	-	-	-	-	-	-	-	-	-	-	-
12-12	0.0182	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.0230	1398	370	8,200	1488	830.1	48	4478	770	3674	690	3718	493
Industrial Plant XVI													
12-7	0.515	-	-	1,860	8000	73.8	317	1076	4625	1084	4480	930	3,990
12-8	0.405	-	-	1,460	4940	58.6	198	688	2330	640	2165	493	1,670
12-9	0.684	-	-	1,640	18,950	99.0	515	2304	12,000	2004	11,490	2170	12,385
12-10	0.448	405	1515	2,180	8,150	37.8	142	1138	4,280	1039	3,860	1050	3,810
12-11	0.528	346	1510	4,180	18,280	59.8	261	1910	8,375	1895	8,250	1540	6,690
12-12	0.607	739	3745	1,880	9,540	21.6	110	1340	6,800	1264	6,410	657	3,180
Average	0.530	496	2260	2,530	11,300	58.4	257	1408	6,383	1343	6,096	1135	5,054

Table 1
Analytical Results
(Cont'd.)

Date	Q MGD	Grease mg/l	Grease #/day	COD mg/l	COD #/day	Organic Nitrogen mg/l	Organic Nitrogen #/day	Total Sus. Solids mg/l	Total Sus. Solids #/day	Vol. Sus. Solids mg/l	Vol. Sus. Solids #/day	BOD mg/l	BOD #/day
Industrial Plant XVII													
12-7	-	-	-	-	-	-	-	-	-	-	-	-	-
12-8	-	-	-	-	-	-	-	-	-	-	-	-	-
12-9	-	1611	-	3620	-	31.8	-	3300	-	3110	-	2370 *	1995
12-10	0.101	333	281	2920	2460	96.2	81	1005	848	820	692	1060	890
12-11	0.104	637	554	4400	3820	127.6	111	1493	1298	1453	1262	1590	1375
12-12	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	0.103	860	420	5650	3140	101.9	96	1933	1073	1794	977	1673	1420

* Assume Q = 0.101

TABLE 2

Analytical Results

Total Coliform (MPN/100 ml)

Station	Average	Median	Geometric Mean
I	14,778,000	10,900,000	8,580,000
II	3,781,000	2,300,000	2,405,000
III	-	-	-
IV	12,160,000	13,000,000	11,180,000
V	11,180,000	13,000,000	10,020,000
VI	6,057,000	3,100,000	3,170,000
VII	20,625,000	16,500,000	8,750,000
VIII	> 44,360,000	49,000,000	> 22,500,000
IX	3,941,000	3,300,000	3,090,000
X	486,000	490,000	485,000
XI	1,570,000	1,095,000	1,330,000
XII	4,967,000	4,750,000	4,350,000
XIII	10,375,000	7,100,000	7,320,000
XIV	8,533,000	6,400,000	6,030,000
XV	6,075,000	5,600,000	5,000,000
XVI	1,243,000	1,510,000	1,016,000
XVII	3,330,000	1,300,000	2,010,000
Monroe St. Sewer	21,700,000	15,100,000	15,100,000
So. Omaha Sewer	17,850,000	14,100,000	15,950,000
S.T.P. - Raw	52,075,000	49,000,000	45,800,000
S.T.P. - Final	33,533,000	25,400,000	27,600,000

TABLE 3

Analytical Results

Fecal Coliform (MPN/100 ml)

Station	Average	Median	Geometric Mean
I	3,638,000	3,300,000	3,000,000
II	2,003,000	1,300,000	1,534,000
III	-	-	-
IV	10,120,000	7,900,000	9,150,000
V	8,900,000	7,900,000	8,290,000
VI	2,226,000	1,100,000	1,383,000
VII	12,125,000	12,500,000	6,490,000
VIII	> 40,560,000	> 16,000,000	> 19,500,000
IX	3,941,000	3,300,000	3,090,000
X	< 322,000	330,000	< 286,500
XI	545,000	595,000	482,000
XII	2,592,000	2,750,000	2,380,000
XIII	3,450,000	2,700,000	2,300,000
XIV	3,050,000	3,300,000	2,820,000
XV	4,275,000	3,950,000	3,910,000
XVI	1,132,000	1,195,000	909,000
XVII	1,267,000	800,000	1,117,000
Monroe St. Sewer	14,100,000	10,900,000	10,500,000
So. Omaha Sewer	5,333,000	4,900,000	4,275,000
S.T.P. - Raw	6,408,000	4,750,000	5,360,000
S.T.P. - Final	5,200,000	4,900,000	3,980,000